

Formulas for Exam 3 and Final Exam

1. Derivatives.

y	x^n	e^x	b^x	$\ln x$	$\log_b x$	$\sin x$	$\cos x$
y'	nx^{n-1}	e^x	$b^x \ln b$	$\frac{1}{x}$	$\frac{1}{x} \cdot \frac{1}{\ln b}$	$\cos x$	$-\sin x$

2. Integrals.

y	x^n	e^x	b^x	$\frac{1}{x}$	$\sin x$	$\cos x$
$\int y \, dx$	$\frac{1}{n+1} x^{n+1}$	e^x	$\frac{1}{\ln b} b^x$	$\ln x $	$-\cos x$	$\sin x$

3. Area between $f(x)$ and x -axis for $a < x < b$:

- If $f(x) > 0$ for $a < x < b$, then area is $\int_a^b f(x) \, dx$
- If $f(x) < 0$ for $a < x < b$, then area is $-\int_a^b f(x) \, dx$
- If $f(x) < 0$ for $a < x < c$ and $f(x) > 0$ for $c < x < b$, then area is $-\int_a^c f(x) \, dx + \int_c^b f(x) \, dx$

Area between $f(x)$ and $g(x)$ if $f(x) > g(x)$ for $a < x < b$: $\int_a^b (f(x) - g(x)) \, dx$

4. Rules of Differentiation

a) Product rule:

$$\text{If } y = f \cdot g, \text{ then } y' = f' \cdot g + g' \cdot f$$

b) Quotient rule:

$$\text{If } y = \frac{f}{g}, \text{ then } y' = \frac{f' \cdot g - g' \cdot f}{g^2}$$

c) Chain rule:

$$\text{If } y = f(g(x)), \text{ then } y' = f'(g(x)) \cdot g'(x)$$

5. Average and instantaneous rate of change.

a) The average rate of change of $f(x)$ over $[a, b]$: $\frac{f(b)-f(a)}{b-a}$

b) The instantaneous rate of change of $f(x)$ at $x = c$: $f'(c)$

6. Tangent Line. $y_0 = f(x_0), m = f'(x_0)$

$$y - y_0 = m(x - x_0)$$

7. Linear Approximations.

$$f(x + dx) \approx f(x) + f'(x)dx$$

8. Velocity and Distance travelled

$$v(t) = s'(t) \quad \text{and} \quad s(t) = \int v(t) \, dt$$